METHODS AND PREPARATIONS OF EXTRACTS OF *UNCARIA* SPECIES WITH REDUCED ALKALOID CONTENT

[001] This application claims benefit of U.S. Provisional Application serial number 60/416,730 filed on October 5, 2002.

BACKGROUND OF THE INVENTION

Field of the Invention.

[002] The present invention is relevant to the field of anti-inflammatories and anti-oxidants and the manufacture of anti-inflammatories and anti-oxidants.

Discussion of the Related Art.

[003] The indigenous inhabitants of the Amazon forests refer to plants from the *Uncaria* species as Uña de Gato ("Cat's claw"). These inhabitants traditionally used the *Uncaria* plant(s) in a raw unprocessed botanical form as a treatment for a wide array of health disorders. More specifically, ethnomedical preparations of *Uncaria* plant(s) were and are today consumed as decoctions or teas made from the bark of *Uncaria* brewed in water. Numerous researchers propose that the *Uncaria* chemical constituents, and particularly the alkaloids oxindole and pentacyclic, are responsible for its immune enhancing action of the plant material.

[004] Today, Cat's Claw is marketed and sold as an herbal medicine throughout the world. The primary form of these commercial preparations entails the manual manipulation of the bark, root or leaves to produce varying particulate powders. Said powders are then encapsulated for oral administration at a suggested dosage of 1-3 grams of crude material per day. It is not obvious nor has it been taught that

these commercial preparations for *Uncaria* duplicate its historical efficacy. As of this writing, a review of the literature reveals that there has never been a single peer-reviewed scientific article demonstrating any human efficacy or health benefits derived from the oral consumption of the crude plant parts of *Uncaria*. Furthermore, since the solid matter from teas or decoctions is discarded (e.g. as a tea bag), it is unclear whether this solid matter would in fact cause stomach irritation, toxicity or limit the absorption of *Uncaria's* active ingredients.

[005] Researchers have identified inherent immunostimulating as well as immunosuppressant actions caused by the diverse chemical constituents of the *Uncaria* species. Researchers have determined that *Uncaria's* immunostimulating actions are attributable to alkaloids, pentacyclic and oxindole, that are more lipophilic than the transcriptionally active immunosuppressant components. There is prior and established art for the extraction and concentration of these lipophilic and immunostimulating alkaloids by various methods primarily utilizing alcohol rather than water as the extracting agent.

[006] Related art exists for the extraction, concentration and determination of *Uncaria's* lipophilic alkaloids extractions with higher alkaloid concentrations (US Patent Nos. 4844901, 4940725, 5302611, 5723625). The method uses aqueous ammonia pretreatment followed by supercritical extraction. The resultant material has been indicated for unspecific stimulation of the immune system as characterized by increased macrophage phagocytosis.

[007] Related art also exists that teaches that a hot water extraction of the crude plant parts of Uncaria and the subsequent dialysis of the solubilized products yields

a composition which has a high degree of the immune stimulatory activities (USPTO Nos. 6039949, 6238675, 6361805). These activities were confirmed through increased lymphocyte phagocytosis and cytokine production and more recently, increased vaccine response. However, while increased leukocyte phagocytosis and cytokine production are characteristics of the immune response, they contribute to tissue injury during states of inflammation. Thus, current therapeutic approaches in treating inflammatory disorders usually seek to lower cytokine levels and inhibit leukocyte activity.

SUMMARY OF THE INVENTION

[008] Aspects of the invention are summarized below to aid in the understanding of embodiment(s) of the invention and the application. Yet, the invention is fully defined by the claims of the application.

[009] In contrast to its immunostimulating alkaloids, preparations or decoctions of *Uncaria* plant material also exhibit an inherent immunosuppressive and anti-inflammatory result. This dichotomy between the immunostimulatory (pro-inflammatory) alkaloids and the immunosuppressive (anti-inflammatory) agents, concurrent yet opposing actions – stimulation and suppression – limit the true potential and benefits of either component. Thus, a method of distinguishing and removing from Uncaria decoctions the immunostimulatory alkaloids would result in an *Uncaria* extract with enhanced efficacy and therapeutic potential of the polar, immunosuppressive, TNF-alpha inhibiting agents. The present invention describes an extract and method for extracting and then depleting from plants of the *Uncaria*

species (Cat's Claw or Uño de gato) it's lipophilic, immunostimulating alkaloids whilst retaining and then further concentrating its polar, immunosuppressive agents. The process generally comprises an organic extraction(s) and drying of decocting crude *Uncaria* plant parts. The resulting *Uncaria* extract is substantially deplete of immunostimulatory actives and retains enhanced anti-inflammatory components and antioxidant capacities.

[010] The *Uncaria* extract described herein demonstrates antioxidant activity and also an ability to inhibit the formation of inflammatory and immune mediators like tumor necrosis factor alpha (TNFalpha) by suppressing the activation of genes associated with inflammation and the immune response. This transcriptional inhibition likely results from suppression of nuclear factor kappa B (NF-kB) and functions to suppress an over active immune response that contributes to tissue injury during states of inflammation. It is counterintuitive that the enhancement and concentration of known immunostimulatory (i.e. pro-inflammatory) alkaloids would act as immunosuppressants and exert any anti-inflammatory activity.

[011] This invention demonstrates that the *Uncaria* extract by the process disclosed herein is characterized by enhanced immunosuppressant and anti-inflammatory action and therefore requires an effective dose twenty times less (i.e. 2 mg/kg) than extracts or decoctions produced by other methods. Anti-inflammatory and transcriptionally acting immune modulating actions of the *Uncaria* extract preparations described herein have application in disorders characterized by NF-kB activation, oxidant burden, enhanced cytokine production and cell death. These disorders include, but are not limited to, arthritis (both osteoarthritis and rheumatoid),

inflammatory bowel disease (IBD), gastritis, chronic inflammation of the eyes, skin, liver, muscles and kidney, fibromyalgia, atherosclerosis, and Alzheimer's disease.

BRIEF DESCRIPTION OF THE FIGURES

[012] FIGURE 1. A comparison of *Uncaria* parent and extract by high performance liquid chromatography (HPLC). As shown in the overlaid chromatograms, the *Uncaria* extract derived from the methods described herein (Vincaria™) is substantially deplete of the immunostimulating alkaloids found in the parent (*Uncaria* spp) whilst retaining and thus enhancing the efficacy and therapeutic potential of the polar, immunosuppressive and TNF-alpha inhibiting (anti-inflammatory) components.

DESCRIPTIONS OF EMBODIMENTS

[013] The *Uncaria* extract(s) prepared by the processed disclosed herein result in a composition that is low in alkaloid content. The descriptions are exemplary methods for the purpose of resolving the extract. An ordinarily skilled practitioner could conceive of variations of the methods in light of the disclosure and the results to be achieved.

[014] Extraction Process 1.

[015] An aqueous extract of the *Uncaria* species is achieved by a decoction method as previously described. A preferred decoction comprises a quantity of raw or dried botanical in hot water. More specifically, solid matter of the plant material such as roots, bark and or powders of genus *Uncaria* are mixed in such a ratio with water that when heated for a period of time at a temperature of approximately 90-100 degrees centigrade, with or without agitation, to yield a brown aqueous extract also

known as a decoction or tea. The decoction or tea is then filtered of all solid matter for further processing according to one aspect of the invention. The filtrate is subsequently dried to remove all aqueous components. Acceptable drying methods include air-drying, evaporation, or vacuum drying or an equivalent.

[016] An organic solvent is subsequently added to the dried decoction or extract. A preferred organic solvent is chloroform/methanol (2:1) added in a volume-to-volume ratio of 1:1 to 1:20. Another suitable organic solvent is ethyl acetate. Following mixing and phase settling the organic layer is removed from the aqueous layer for further processing according to one aspect of the invention. The solutes contained within the aqueous extract are then resolved by one of several drying processes: heating, air drying, freeze-drying or vacuum drying. Depletion of alkaloids content is confirmed by high performance liquid chromatography (HPLC) as indicated in Figure 1.

[017] Extraction Process 2.

[018] An aqueous extract of the *Uncaria* species is achieved by a decoction method as previously described. To this extract in its liquid phase the organic solvent ethyl acetate, is added. Following agitation and settling the organic layer is separated from the aqueous and the organic layer discarded. The solutes remaining in the aqueous layer are the resolved by drying. Several drying processes can be used: heating, air-drying, freeze-drying, or vacuum drying. Depletion of alkaloids content is confirmed by high performance liquid chromatography (HPLC) as indicated in Figure 1.

[019] Extraction Process 3.

[020] This process employs the same decoction extraction method as described for Examples 1 and 2, but before the extraction of organic material is employed; the solute in the decoction is isolated by drying. To this dried powder the organic solvents are added (chloroform/methanol, 2:1: or ethyl acetate). This mixture is agitated for adequate mixing, followed by settling. The liquid organic solvent is removed and discarded, and the solutes are dried again as outlined by similar methods employed for drying in Example 1 or 2. Depletion of alkaloids content is confirmed by high performance liquid chromatography (HPLC) as indicated in Figure 1.

[021] **Table 1: Antioxidant and anti-TNFalpha actions of cat's claw formulations.** Note that in order to assess activity in micropulverized *Uncaria*, a hot water extraction was performed and this decoction used for evaluation. TNFapha production was assessed in cultured macrophages (RAW 264.7 cells) stimulated with bacterial endotoxin (LPS: 0.5 μg/mL). After one hour exposure to LPS, media was collected and TNFalpha levels measured by ELISA. DPPH scavenging was spectophometerically measured by a reduction in absorbance at 515 nm. Results are depicted as IC_{50}, which is the concentration that produces a 50% inhibition. A lower IC_{50} value is indicative of greater potency. Note: For each assay, potency was significantly greater in alkaloid depleted freeze-dried formulation when compared to the other formations ($P<0.01$)

Assay IC_{50}	Freeze-dried Alkaloid Deplete Uncaria (Vincaria™)	Freeze-dried Uncaria Alkaloid Intact	Micropulverized Uncaria Alkaloid Intact
DPPH	12.6 μg/mL	20.8 μg/mL	150 μg/mL

Anti-TNFalpha	9.5 ng/mL	14.1 ng/mL	28 ng/mL

[022] Antioxidant Activity

[023] The extract processed according to the invention and produced from freeze-dried *Uncaria* plant matter a composition with enhanced antioxidant activity or ability to scavenge the stable free radical 2,2'-dipyridyl-2-pyridylhydrazone (DPPH) as compared to those preparations made from the manual manipulation of the bark, root or leaves to produce particulate powders. As demonstrated in Table 1, it has a lower 50% effective concentration (IC50) for scavenging DPPH radicals than compared powdered formulations.

[024] Inhibition of TNFα Formation

[025] The extract processed according to the invention and produced a composition with an enhanced ability to inhibit the formation of tumor necrosis factor alpha (TNFα) by macrophages stimulated by bacterial endotoxin [lipopolysaccharide (LPS)]. This activity is superior to the compared powdered formulations as well as freeze-dried preparations containing higher alkaloid content (Table 1). This supports the indication that the alkaloid constituents of the *Uncaria* species are not the components responsible for its immunosuppressive activity but rather suggest their role in the enhancement of the immune system.

[026] Alkaloid Depletion

[027] *Uncaria* derived alkaloids (both pentacyclic and oxindole) have been suggested as the constituents responsible for its immuno-enhancing activity.

However, in the treatment of inflammatory disease, the enhancement of the immune response is counter-productive while the suppression of an overactive immune system is the more common and logical approach to therapy and a target for therapeutic innovations. Thus, for enhanced anti-inflammatory actions, it is necessary to deplete effective *Uncaria* formulations of these alkaloids.

[028] The extraction method herein described entails the concentration of *Uncaria*'s active components by decoction and then the depletion of the alkaloid content through chemical manipulation with organic solvents. More particularly, the *Uncaria* extract is significantly deplete of oxindole, pentacyclic and tetracyclic alkaloid when compared to the parent botanical. These alkaloids are more lipophilic than the active antioxidant and NF-κB suppressive components. Thus, treatment of a decoction of *Uncaria* plant material with an organic solvent to resolve the aqueous (i.e. non-organic components) significantly reduces the alkaloid content whilst retaining the polar anti-inflammatory compounds. As clearly shown in Table 1, specific alkaloids used as markers to quantify the resultant composition's alkaloid content demonstrate 35-fold depletion with an associated improvement in antioxidant and anti-TNFα action.

[029] Laboratory results indicate that the oxindole alkaloid content of the *Uncaria* extract processed as described herein is less than 0.3 mg/g of dired decoction. Decoctions are generally 20% of the parent *Uncaria* plant material. Thus, the non-alkaloid components are 5 times concentrated, or approximately 0.06mg/g of raw botanical. Normal or starting detected values of oxidole alkaloid content are 9 mg/g of decoction or 1.8 mg/g of raw botanical. The extraction procedure reflects a

depletion of at least 30 fold resulting in an almost undetectable quantity of oxidole alkaloids.

[030] A pharmaceutical dosage comprising a biologically active amount of the *Uncaria* extract produced as taught herein is contemplated for use singularly or in combination with other ingredients for human and animal use. Moreover particularly, a pharmaceutical dosage comprising a biologically active amount of the *Uncaria* extract can be embodied in suppositories, oral, topical, injectable or inhalable formats.

[031] The pharmaceutical dosage comprising a biologically active amount of the *Uncaria* extract is administered in a quantity sufficient to ameliorate conditions characterized by NF-kB activation, oxidant burden, enhanced cytokine production and cell death. The conditions are contemplated to include, but are not limited to, arthritis (both osteoarthritis and rheumatoid), inflammatory bowel disease (IBD), gastritis, chronic inflammation of the eyes, skin, liver, muscles and kidney, fibromyalgia, atherosclerosis, and Alzheimer's disease.

[032] While the invention has been described with reference to specific preferred embodiments and uses, it is certainly not limited to those precise embodiments or uses. Rather, many modifications, variations and applications will become apparent to persons skilled in the art without departure from the scope and spirit of the invention, as defined in the appended claims.